



## REMOTE SENSING AND GIS FOR WASTELANDS AND LAND UTILISATION STUDIES OF PERIYA KALRAYAN HILL, SALEM AND VELLUPURAM DISTRICT

*Dr. A. Ilanthirayan*

*Assistant Professor, Department of Geography, Govt Arts College (A), Salem, Tamil Nadu, India*

### **ABSTRACT**

*Wastelands and Land use change is one of the important aspects of the regional ecological restoration research. With remote sensing (RS) image in 2003, 2007 and 2012, using geographic information system (GIS) technologies, the land use pattern changes in Periya Kalrayan hill mountain ecological restoration area in Salem and Villupuram district and its driving force factors were studied. Ecological Restoration can greatly change the micro topography, increase vegetation coverage, and then induce significant changes in the land use distribution, which were the main driving force factors of the land use pattern change in the ecological restoration area.*

**KEYWORDS** Land Use and Land Cover Studies, Remote Sensing and GIS

---

### **Article History**

**Received:** 17 Apr 2022 | **Revised:** 28 Jul 2022 | **Accepted:** 30 Jul 2022

---

### **INTRODUCTION**

Land use involves the management and modification of natural environment or wilderness into built environment such as settlements and semi-natural habitats such as arable fields, pastures, and managed woods. A. K. Harshika and Sopan I. Land Use Land Cover Classification and Change Detection Using High Resolution Temporal Satellite Data and A.O. Zubair Change Detection in Land Use and Land Cover Using Remote Sensing Data and GIS (A case study of Ilorin and its environs in Kwara State), Land use practices vary considerably across the world. The United Nations' Organization Water Development Division explains that "Land use concerns the products and/or benefits obtained from use of the land as well as the land management actions (activities) carried out by humans to produce those products and benefits." C. Prakasam Land use and land cover change detection through remote sensing approach: A case study of Kodaikanal Taluk, Tamil Nadu. As of the early 1990s, about 13% of the Earth was considered arable land, with 26% in pasture, 32% forests and woodland, and 1.5% urban areas. Land change modelling can be used to predict and assess future shifts in land use.

### **STUDY AREA**

The Kalvarayan Hills are a major range of hills situated in the Eastern Ghats of the southern Indian state of Tamil Nadu. Along with the Pachaimalai, Alavaimalai, Javadi, and Shevaroy hills, they separate the Kaveri River basin to the south from the Palar River basin to the north. The hills range in height from 2000 feet to 3000 feet and extend over an area of 1095 square kilometres. The Kalrayan Hills are one of the largest hills in Eastern Ghats in Tamil Nadu next to Javadi Hills. The Kalrayan Hills occupy an area of about 1145.82 km.

Periya Kalrayan hill lies between 78°30'and 78°45' of the North latitude and between 12°0'and 11°45'of the East longitude. The study area a total of 49 panchayat villages, climate is mainly tropical in nature with a cooler period from December to February. Periya Kalrayan hill of Viluppuram District. Blocks of Periya Kalrayan area are Vellimalai, Maniyarapalaym, Arampundi, Varam, Periya Kalrayan hill of Total Blocks 23. (Map 1). The major rivers flowing in this region are Pambar and Vellar. Vellar is a river which originates in the Shevaroy Hills and runs through the districts of Salem, Perambalur and Cuddalore in the northern part of the Indian state of Tamil Nadu before draining into the Bay of Bengal near Parangipettai. The hills comprise of basic crystalline metamorphic rocks of Archaean age i.e., composite Gneiss, Charnockites, Ultramafic rocks, Magnetite and Granites. The alluvium is noted along the river courses and restricted in its thickness. The soil type varies from red loam to black clay. The soil on the plateau is generally red loam and on the outer slopes is replaced by shallow red gravel with boulders. The maximum relief is 900 metres and minimum relief is 214 metres. The elevation found at maximum elevation Based on the relief analysis by the max-minimum slope found at south western margin of study area. As per 2001 population, Chinna Kalvarayan has over 20,000 and Periya Kalvarayan has 15,000 people. The community had wedding tax, cultivation tax, registration of births and deaths, and everyone had to offer gifts to jagirdhar's families during Pongal celebrations.

## **OBJECTIVES**

- To study base information of the hill environment around fit for the land to management view of waste land to convert as possible cultivable land.
- To Mapping of Land use/Land cover of the study area with also the among the land in wasteland categories, and also possible land for capable and suitable in agricultural activities.
- To check by the field visit and find the existing cultivable land around the hill environment, were changes of Land use classes
- To final short list and bring out the possible cultivable land for suitability view.

## **RESEARCH METHODOLOGY**

Based on the objectives in the Periya Kalrayan hill environment, have carried the Land use and Land cover studies of Periya Kalrayan Hill environment. To followed by the field visit and check the primary level Land use/Land cover classes find in the time of the field. To collect the villages level details, tribal habitation with their agricultural activities. In addition to this also prepare the base map by survey of Indian topsheet 2011 with Satellite Imagery 2016-Landsat-LOI for the changing Land use Pattern.

## **RESULT AND DISCUSSION**

### **Introduction**

A. M. Talha, A. Javed, and M. Y. Khanday. "SpatioTemporal Land Cover Analysis in Makhawan Watershed (M.P.), India through Remote Sensing and GIS Techniques. Patekar, P.R., and Patil, R.R. Land Use-Land Cover Change Detection Using Remote Sensing and GIS Techniques; Solapur District of Maharashtra, India .The study area located Southern portion of the Periya Kalrayan and it extents 77°45'-77°55" East latitude , 11°35'-11°30'North Longitude. Located in the Salem district of the state, Tamil Nadu is one of the most important textile areas. It is situated 34 km from Salem. Palar River and the Kalarayn Mountain, which is 5 km away from the town, are the major geographical features of this region.

The economy of the town revolves around the manufacture of towels and Kariya Koil dam, Gomuki dam and Vellimalai falls the nearest tourist spot and many cinema shootings were taken here.

### **Water Bodies**

There is found the two more lake via Mannur and Muttal. The remaining water joins the river Cauvery in the sub-watersheds. The important works in the area are agriculture, weaving and other allied activities. The major food crops are paddy, ragi, sugarcane, banana and other crops in and around of the study areas.

### **Forest Land**

Forest land classification is available in dense and open scrub in the sub-watershed, mostly the open scrub is found in the sub-watershed. The sub-watershed Karumandurai, Mannur and Muttal one of the important settlement in the study area. The most of the vegetative cover is along the river course of Palar and their adjoining of natural tanks

### **Waste Land**

The remaining of the Land use categories the waste land is either land used or unused in the agricultural activities or otherwise the land area not fertile in soil or water in the particular areas. The present study area southern portion of the Kalrayan hill environment located in the central portion of the study area. The few waste land found in the surrounded all areas.

This is the land, which is generally prone to deterioration due to erosion. Such lands generally occupy topographically high locations, excluding hilly/mountainous terrain. Based on the presence of vegetation cover, two subclasses could be delineated i.e., land with dense scrub and land with open scrub. Land with dense scrub these areas have shallow and skeletal soils, at times chemically degraded, extremes of slopes, severely eroded and are subjected to excessive aridity with scrubs dominating the landscape. They have a tendency for intermixing with croplands. Land with open scrub this category is same as mentioned in the earlier category except that it has sparse vegetative cover or is devoid of scrub and has a thin soil covers.

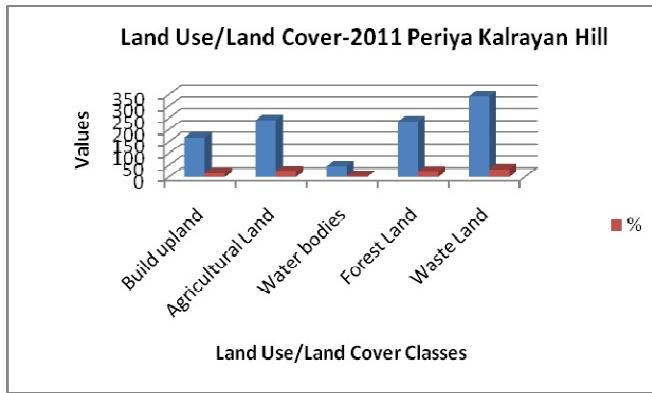
### **Land Use and Land Cover 2011**

Periya Kalrayan hill streams, Sub-Watershed is located upper portion of the North portion watershed study area with potential resources for agricultural and other allied activities. The sub-watershed included the Sub villages, Vellimalai, Kariyalur, Innadu and Serappatau east and west. The major Land use/Land cover is Agriculture, Forest, Fallow land and water bodies like canal and natural tanks. The natural tanks like found in and around of the study area. (Map 1)

**Table 1. Land Use /Land Cover-2011, Periya Kalrayan Hill**

<b>Land Use/Land Cover-Periya Kalrayan Hill</b>			
<b>S.No</b>	<b>LUC</b>	<b>2011-area</b>	<b>%</b>
1	Build upland	167	16.21
2	Agricultural land	241	23.39
3	Water bodies	45	4.36
4	Forest Land	235	22.84
5	Waste Land	342	33.2
		1030	100

Source: SOI 2011



**Figure 1: Land Use /Land Cover-2011, Periya Kalarayan Hill.**

Figure 1 and Table1 reveal that in 2011, about  $749.98 \text{ km}^2$  area of under the Land use and Land cover was under, Build up land 167(16.21%), Agricultural Land241(23.39% ), Water bodies45(4.36 %), Forest land 235(22.84 ), Waste land 342 (33.2 ) and other land use. Table 1 and Figure 1 showing the Land Use/Land Cover classes of the Periya Kalrayan of the study area in the year of 2011. It indicates the absence of the rainfall for changes of land use/land cover in the watershed. From the study the last five years the Current fallow, double/triple and wasteland was increased in the watershed. In other wards the study sub-watershed is part of the foot hills of the Kalrayan hill and semi-fertile nature one. The major lakes supported to improve the well water. The figure showing the overall status of the Land use in the area.

#### **Land Use and Land Cover 2016, Periya Kalarayan Hill**

Periya Kalrayan hill stream Sub-Watershed is located upper portion of the Sarabanga watershed study area with potential resources for agricultural and other allied activities. The major Land use/Land cover is Agriculture, Forest, Fallow land and water bodies like canal and natural tanks. (Map 2)

**Table 2: Land Use /Land Cover-2016, Periya Kalarayan Hill**

Land Use/Land Cover-Periya Kalrayan Hill			
S. No	LUC	2016-area	%
1	Build upland	220	20.27
2	Agricultural land	143	13.17
3	Water bodies	35	3.22
4	Forest Land	275	25.37
5	Waste Land	412	37.97
		1085	100

Source: Land sat -LOI

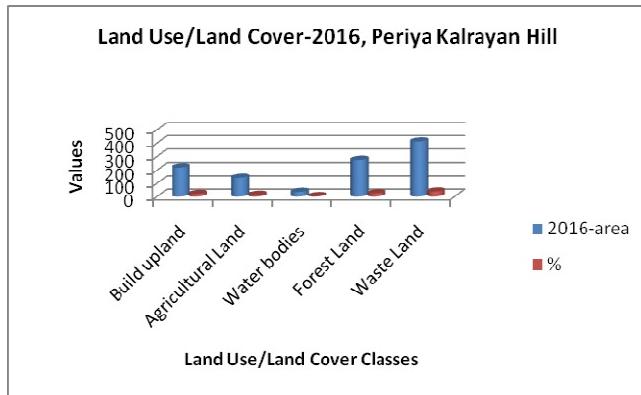
**Figure 2: Land Use /Land Cover-2016, Periya Kalrayan Hill.**

Figure 2 and Table 2 reveal that in 2016, about  $749.98 \text{ km}^2$  area of under the Land use and Land cover was under, Build up land 220(20.27%), Agricultural Land143(13.17), Water bodies 35(3.22 %), Forest land 275 (25.37), Waste land 412 (37.97) and other land use. Table 2 and Figure 2 showing the Land Use/Land Cover classes of the Periya Kalrayan hill of the study area in the year of 2016. It indicates the absence of the rainfall for changes of land use/land cover in the watershed. From the study the last five years the Current fallow, double/triple and wasteland was increased in the watershed. In other wards the study sub-watershed is part of the foot hills of the Kalrayan hill and semi-fertile nature one. The major lakes supported to improve the well water. The figure showing the overall status of the Land use in the area.

#### **Land Use and Land Cover Studies of Periya Kalarayan Hill**

#### **Changing Pattern of Land Use/Land Cover- Periya Kalarayan Hill**

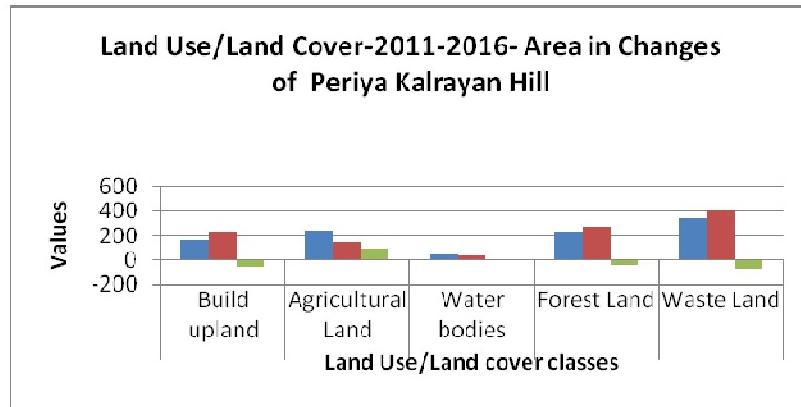
The Land Use/Land Cover of the **Periya Kalarayan hill** from North western portion of the Salem and Villupuram District, it is flow towards NW-SE of the study area and it is join in Manimuktha river in the east. The present study is Land Use and Land cover in the, **Periya Kalarayan hill**. The land use categories available in the study area like built up land, Triple/double, scrub land, waste land, rabi/kharif, Evergreen forest also too. Phukan, P., Thakuria, G., and Saikia, R. Land use Land Cover Change Detection Using Remote Sensing and GIS Techniques - A Case Study of Golaghat District of Assam, India and R. S. N. Prasad, K. P. Rao, R. R. Hermon, and V. Madhavarao Site Suitability Analysis for Water Harvesting Structures in Watershed Using Geo-Informatics.

**Table 3: Land Use/Land Cover (2011–2016), Periya Kalarayan Hill**

S.No	LUC	1971-area	2016-area	Changes
1	Build upland	167	220	-53
2	Agricultural Land	241	143	98
3	Water bodies	45	35	10
4	Forest Land	235	275	-40
5	Waste Land	342	412	-70
		1030	1085	

**Source: SOI-Land sat LOI**

Figure 3 and Table 3 reveal that in 2011, about  $749.98 \text{ km}^2$  area of under the Land use and Land cover was under, Build up land 167 (16.21%), Agricultural Land 241 (23.39%), Water bodies 45 (4.36 %), Forest land 235 (22.84), Waste land 342 (33.2) and other land use. Figure 2 and Table 2 reveal that in 2016, about  $748.98 \text{ km}^2$  area of under the Land use and Land cover was under, Build up land 220 (20.27%), Agricultural Land 143(13.17), Water bodies 35(3.22 %), Forest land 275 (25.37), Waste land 412 (37.97) and other land use.



**Figure 3: Land Use/Land Cover (1971–2016), Periya Kalarayan Hill.**

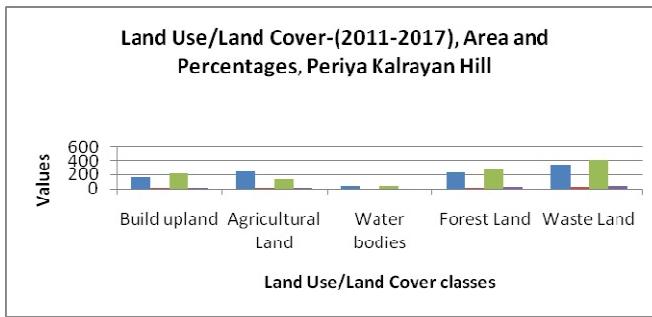
Table 3 and Figure 3 showing the Land Use/Land Cover classes of the Idappadi sub-watershed of the study area in the year of 2011-2016. It indicates the absence of the rainfall for changes of land use/land cover in the watershed. From the study the last five years the Current fallow, double/triple and wasteland was increased in the watershed. In other wards the study sub-watershed is part of the foot hills of the Kalrayan hill and semi-fertile nature one. The major lakes supported to improve the well water. The figure showing the overall status of the Land use in the area.

### PERIYA KALRAYAN HILL

In 2011& 2016 the study area Periya **Kalarayan hill** has occupied. This area has a multi various land use. Such land use has been identified and the area has been calculated, the land under use of Current Fallow, Deciduous Forest, Double/Triple, Evergreen forest, Kharif/Rabi, Waste land, Scrub land and Water bodies.

**Table 4: Changing Land Use /Land Cover Pattern 2011-2016 Periya Kalarayan Hill**

S.No	LUC	2011-area	%	2016-area	%
1	Build upland	167	16.21	220	20.27
2	Agricultural land	241	23.39	143	13.17
3	Water bodies	45	4.36	35	3.22
4	Forest land	235	22.84	275	25.37
5	Waste land	342	33.2	412	37.97
		1030	100	1085	100



**Figure 4: Changing Land Use /Land Cover Pattern 2011-2016, Periya Kalarayan Hill.**

### **Agricultural Land**

From the two variable years of changing land use classes of agricultural land was rapidly changes found between 2011-2016 in area in the past 35 years of the Kalrayan hill. The Periya Kalrayan is one of the major portion and as well as the fertile agricultural land, along the area benefits for land utilization. K. Tarun and D. C. Jhariya "Land quality index assessment for agricultural purpose using multi-criteria decision analysis (MCDA)", The land is very potential and environmentally very important located along the river Cauvery.

### **Built Upland**

The built upland is found in slightly in and around of the watershed because of the agricultural land in 2011. The mostly the paddy crop with plantation activities around the watershed. In the 2016 data is found the huge built up land along the agricultural land to convert residential activities.

### **Waste Land**

In this part of Land use/Land cover, Waste Land both 2011 and 2016 years, 37.97 percent. The land use change different is there is no changes in the categories. For the most reason is may be the cultivators will not practice or sometimes the unavailable of the water, either well or ground water.

### **Forest**

Deciduous Forest Land includes all forested areas having a predominance of trees that lose their leaves at the end of the frost-free season or at the beginning of a dry season. This type of the forest was changed, compare to 2011 the year of 2016 was 25.37 percent decreased, because of the social forest scheme was implemented by the local authorities in and around of the sub-watershed.

### **Water Bodies**

From the Periya Kalrayan, is included the various lakes in and around the study area. In addition to this also have the canal and well irrigation randomly around the study area. When the field visit and meet the farmer, they are not used the lake water, but utilize only the well water for the agricultural and other domestic purpose.

### **Land Use and Land Cover Changes analysis (2011-2016)**

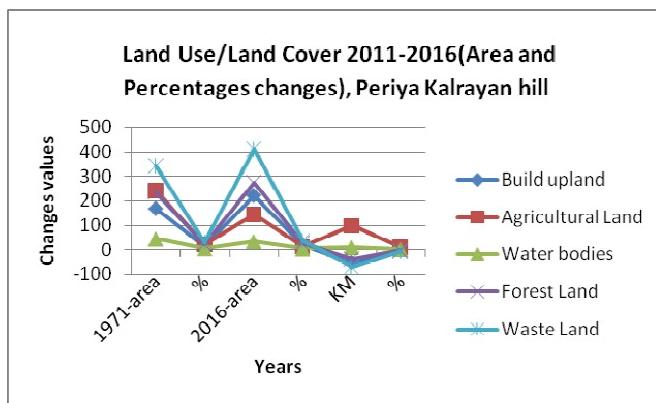
#### **Periya Kalrayan Hill**

The study of sub-watershed in Periya **Kalarayan hill** 2011 and 2016 showing Figure 5 and Table 5 reveal that in 2011, under the Land use and Land cover was under, Build up land 167(16.21 %), Agricultural Land 241 (23.39 %), Water bodies 45(4.36 %), Forest land 235(22.84 %), Waste land 342 (33.2 %) and other land use. Figure 2 and Table 2 reveal that in 2016, under the Land use and Land cover was under, Build up land 220(20.27%), Agricultural Land 143(13.17 ), Water bodies 35(3.22 %), Forest land 275 (25.37 %), Waste land 412 (37.97 %) and other land use.

**Table 5: Changing Land Use/Land Cover Pattern of Periya Kalarayan Hill 1971–2016 (LANSAT LOI)**

S.No	LUC	1971-area	%	2016-area	%	KM	%
1	Build upland	167	16.21	220	20.27	-53	-4.06
2	Agricultural land	241	23.39	143	13.17	98	10.22
3	Water bodies	45	4.36	35	3.22	10	1.14
4	Forest land	235	22.84	275	25.37	-40	-2.53
5	Waste land	342	33.2	412	37.97	-70	-4.77
		1030	100	1085	100		

The status of the land use/land cover changes in the sub-watershed, from that the figure compare to 2011, the 2016 year was rapid changes of the land. The percentage of the changes of the land categories showing the figure evergreen forest, kharif, other waste land are negative changes. In general positive changes like improve the vegetative cover due to the various plantation scheme by the government and other NGO participation in the due course.

**Figure 5: Changing Land Use/Land Cover Pattern of Periya Kalarayan Hill 2011-2016.**

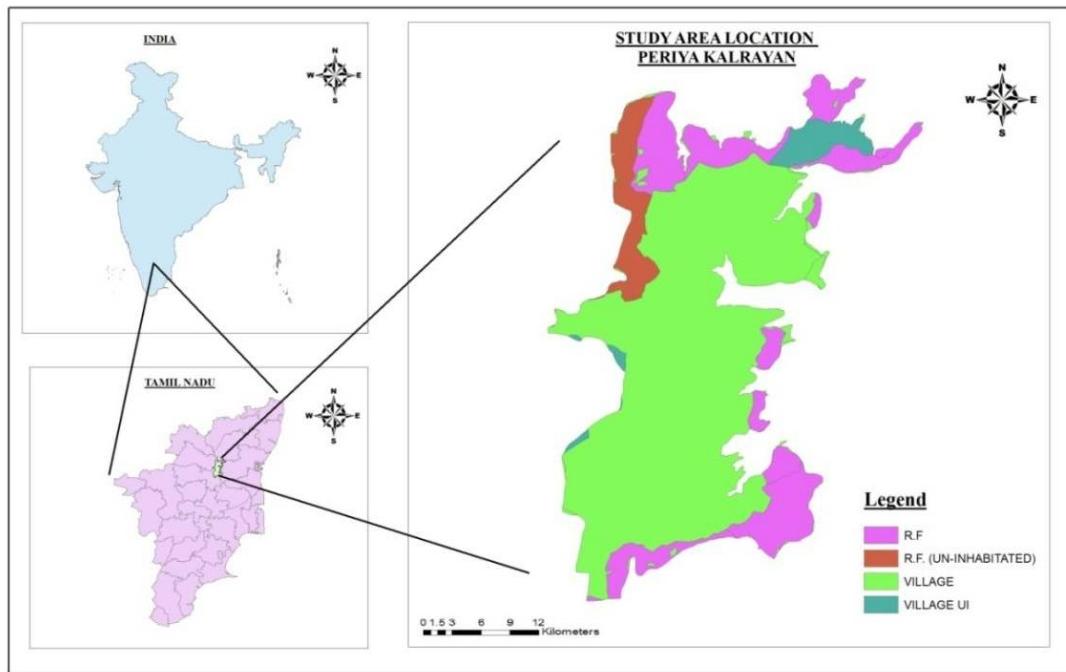
The overall changing land use/Land cover of the sub-watershed , Kharif (3.76%),Double/Triple(47.18%), Scrub Land(1.44%), Deciduous and Evergreen forest(38.81 %) and no changes is Current fallow and water bodies in the sub-watershed of the Idappadi. The study area located along the Shervaryan hill with potential land, soil and water resource. The cultivators mostly utilized the well and sometimes the canal irrigation for their agricultural activities.

## CONCLUSION

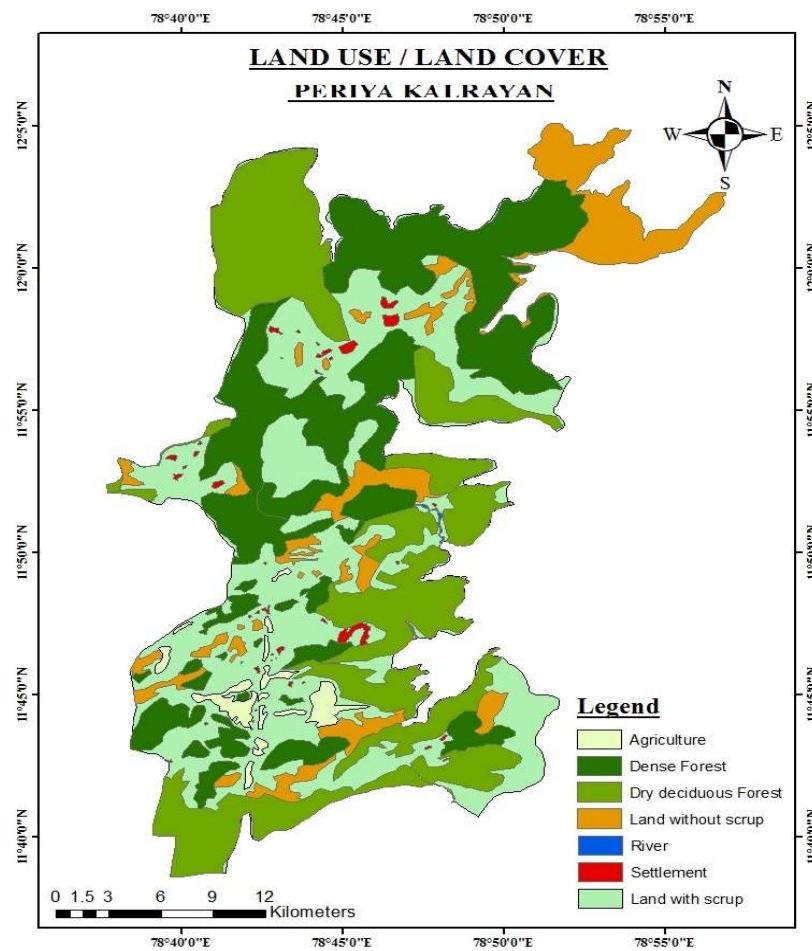
Periya Kalarayan hill 2011 and 2016 showing Figure 5 and Table 5 reveal that in 2011 , under the Land use and Land cover was under, Build up land 167(16.21%), Agricultural Land 241(23.39% ), Water bodies 45(4.36 %), Forest land 235(22.84 ), Waste land 342 (33.2 ) and other land use. Figure 2 and Table 2 reveal that in 2016, under the Land use and Land cover was under, Build up land 220(20.27%), Agricultural Land 143(13.17 ), Water bodies 35(3.22 %), Forest land 275 (25.37 ), Waste land 412 (37.97 ) and other land use. The overall changing land use/Land cover of the sub-watershed, Kharif (3.76%),Double/Triple(47.18%), Scrub Land(1.44%), Deciduous and Evergreen forest(38.81 %) and no changes is Current fallow and water bodies in the sub-watershed of the Periya Kalrayan hill. The study area located along the Shervaryan hill with potential land, soil and water resource. The cultivators mostly utilized the well and sometimes the canal irrigation for their agricultural activities.

## REFERENCES

1. A.K. Harshika and Sopan I. Land Use Land Cover Classification and Change Detection Using High Resolution Temporal Satellite Data, *Journal of Environment*: Vol. 01, Issue 04, pp. 146-15, 2012.
2. A.O. Zubair Change Detection in Land Use and Land Cover Using Remote Sensing Data and GIS (A case study of Ilorin and its environs in Kwara State), M. Sc. Project, Department of Geography, University of Ibaden, 2006.
3. Prakasam Land use and land cover change detection through remote sensing approach: A case study of Kodaikanal Taluk, Tamil Nadu, *International Journal of Geomatics and Geosciences* Vol. 1, No 2, 2010.
4. R. S. N. Prasad, K. P. Rao, R. R. Hermon, and V. Madhavarao Site Suitability Analysis for Water Harvesting Structures in Watershed Using GeoInfomatics. *Integrated Land Use Planning for Sustainable Agriculture and Rural Development* Apple Academic Press.131-140. 2016
5. A.M. Talha, A. Javed, and M. Y. Khanday. "SpatioTemporal Land Cover Analysis in Makhawan Watershed (M.P.), India through Remote Sensing and GIS Techniques", *Journal of Geographic Information System*, 6; 298-306, 2014.
6. K. Tarun and D. C. Jhariya "Land quality index assessment for agricultural purpose using multi-criteria decision analysis (MCDA)", *Geocarto International*, 822- 841, 2015.
7. Patekar, P.R., and Patil, R.R. Land Use-Land Cover Change Detection Using Remote Sensing and GIS Techniques; Solapur District of Maharashtra, India. *International Journal of Advanced Remote Sensing and GIS*. 2014. 3 (1) 499-505.
8. Phukan, P., Thakuria, G., and Saikia, R. Land use Land Cover Change Detection Using Remote Sensing and GIS Techniques - A Case Study of Golaghat District of Assam, India. *International Research Journal of Earth Sciences*. 2013. 1 (1) 11-15.
9. N.C. Anil, G.J. Sankar, M. J. Rao, I.V.R.K.V. Prasad and U. Sailaja Studies on Land Use/Land Cover and change detection from parts of South West Godavari District, A.P – Using Remote Sensing and GIS Techniques. *J. Ind. Geophys. Union* Vol.15, No.4, pp.187-194, October 2011
10. Zende, Abhijit M., et al. "Remote Sensing and GIS Applications for Terrain Evaluation and Land Resources Assessment in Yerala River Basin, Western Maharashtra, India." *Research and Development (IJCSEIERD)* 2.2 (2012): 17-24. *International Journal of Civil, Structural, Environmental and Infrastructure Engineering Research and Development (IJCSEIERD)* ISSN 2249-6866 Vol.2, Issue 2 June 2012 17-24
11. Manjunath, H., and T. S. Suresh. "Morphometric and land use/land cover based subwatershed prioritization of Torehalla using remote sensing and GIS." *International Journal of Applied and Natural Sciences (IJANS)* 3.1 (2014): 41-48. *International Journal of Applied and Natural Sciences (IJANS)* ISSN(P): 2319-4014; ISSN(E): 2319-4022 Vol. 3, Issue 1, Jan 2014, 41-48

**APPENDIX**

**Map 1: Study Area-Periya Kalrayan Hill.**



**Map 2: Land Use/Land Cover-Periya Kalrayan Hill.**

